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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/010,162	11/20/2001	Fwu-luan Hshieh	GS 149	7266

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EXAMINER

ROMAN, ANGEL

ART UNIT PAPER NUMBER

2812

DATE MAILED: 07/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/010,162

Applicant(s)

HSHIEH ET AL.

Examiner

Angel Roman

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on _____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 November 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2, 6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because the lines and numbers defining the drawings are blurred and not clearly legible. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-9 and 11-20 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Tsang et al. U.S. Patent 5,283,201 A.

Tsang et al. discloses a method of forming a trench MOSFET comprising; providing a semiconductor wafer 122 of a first conductivity type; depositing an epitaxial layer 24 of said first conductivity type over said wafer, said epitaxial layer 24 having a lower majority carrier concentration than said wafer 122 forming a body region 26 of a second conductivity type within an upper portion of said epitaxial layer 24; providing a patterned first masking material layer 36 over said epitaxial layer 24 using a chemical vapor deposition method, said patterned first masking material layer 36 comprising a

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first aperture; depositing a second masking material layer 144 over said first masking material layer 36 using a chemical vapor deposition method; etching said second masking material layer 144 until a second aperture is created in said second masking material layer 144 within said first aperture, said second aperture being narrower than said first aperture; forming a trench in said epitaxial layer 24 by etching said semiconductor wafer 122 through said second aperture (see figure 14); forming an insulating layer 160A lining at least a portion of said trench; forming a conductive region 162A within said trench adjacent said insulating layer 160A; and forming a source region of said first conductivity type within an upper portion of said body region 26 and adjacent said trench (see figure 20).

Said patterned first masking material layer 36 is provided over said semiconductor wafer 122 by a method comprising; providing a first masking material layer 38 over said epitaxial layer 24; applying a patterned positive photoresist layer 38 over said first masking material layer 36; and etching said first masking material layer 36 through an aperture in said patterned photoresist layer 38 such that said first aperture is formed in said first masking material layer 36 (see figure 3).

Said semiconductor wafer 122 is a silicon wafer (see column 9, line 58) and said epitaxial layer 24 is a silicon epitaxial layer.

Said first and second masking material layers (36, 144) are of the same Silicon dioxide (see column 5, lines 67-68-column 6, lines 24-30) material composition (see column 9, lines 50-54).

Said process of etching said second masking material is an anisotropic, dry oxide-etching process (see column 6, lines 24-30).

Said processes of etching said first and second masking material layers are anisotropic, dry oxide-etching processes (see column 6, lines 1-5).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsang et al. U.S. Patent 5,283,201 A.

Tsang et al. is applied as above but lacks anticipation on disclosing a first trench mask aperture ranging from 0.4 to 0.8 microns across in smallest dimension and a second trench mask aperture ranging from 0.2 to 0.6 microns across in smallest dimension. Tsang et al. discloses first and second trench mask apertures having different thickness values but does not disclose a particular value for this parameter. However, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide a first trench mask aperture ranging from 0.4 to 0.8 microns across in smallest dimension and a second trench mask aperture ranging from 0.2 to 0.6 microns across in smallest dimension in the primary reference of Tsang et al., since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the "optimum range" involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Conclusion


7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Roesner et al., Kubo and Zeng et al. disclose methods of forming trench transistors within semiconductor substrates by using first masks layers and second masks layers within first masks layers apertures, and etching silicon substrates through the first masks layers to form second apertures thinner than said first apertures.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angel Roman whose telephone number is (703) 306-0207. The examiner can normally be reached on Monday-Friday 8:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (703) 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

AR
June 30, 2003


John F. Niebling
Supervisory Patent Examiner
Technology Center 2800